

Thorax CT findings of patients with hilar enlargement on chest X-Ray

Hilar enlargement

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Abstract

Aim: In this study, we aimed to evaluate CT findings of those hila that are thought to be enlarged on chest X-rays. **Material and Method:** We reviewed contrast-enhanced thoracic CT scans of 1000 patients (653 males/ 347 females) admitted to the hospital with various pulmonary complaints. We included CT scans into this study if the requesting physician mentioned that CT examination should evaluate the hilar enlargement seen on chest X-ray. We evaluated both hila on CT regarding the diameter of pulmonary arteries and the size of hilar lymph nodes if exist. A right pulmonary artery diameter larger than 20 mm and a left pulmonary artery diameter larger than 22 mm were considered as vascular dilatation. A hilar lymph node with a short axis diameter equal or greater than 11 mm was noted as lymphadenomegaly. **Results:** Thoracic CT findings were abnormal in 412 (41.2%) patients. Vascular dilatation was the most common etiology of hilar enlargement at 24.8%. Excluding vascular dilatations, thoracic CT findings were abnormal in 16.4% of the patients. After diagnostic work-up, a definitive diagnosis was reached in 51 patients (5.1%). Interstitial lung disease (n=28) and lung cancer (n=16) were the most common diagnoses. **Discussion:** A contrast-enhanced thoracic CT is the best way to determine the etiology of hilar enlargement. In this study, the ratio of abnormal findings (vascular dilatations, lymphadenopathy, lymphadenopathy and vascular dilatation, mass) was 41.2%. We think that this ratio was high enough to justify the request of thoracic CT by the physicians.

Keywords

Chest Radiography; Computed Tomography; Hilar Enlargement; Lung Cancer; Vascular Dilatation

DOI: 10.4328/ACAM.6199 Received: 06.02.2019 Accepted: 25.02.2019 Published Online: 01.03.2019 Printed: 01.05.2020 Ann Clin Anal Med 2020;11(3):235-238
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Introduction

The chest radiography is the prime imaging investigation in respiratory medicine. The standard views of the chest are the posteroanterior (PA) and lateral projections. The hila can be conveniently defined as those areas in the center of the thorax that connect the mediastinum to the lungs [1]. On PA chest radiography, the hila are constructed by pulmonary arteries and superior pulmonary veins. The interpretation of hila is an important step of a systematic review of the chest radiography. Hilar lymphadenopathies, masses or vascular dilatations are the main etiologies of hilar enlargement. Contrast-enhanced computed tomography (CT) is superior in assessing these hilar structures properly [2]. Reviewing the literature, we did not realize such a study evaluating the thoracic CT findings of patients with hilar enlargement on PA chest radiography. In this study, we aimed to investigate the etiologies of hilar enlargement on PA chest radiography by performing a contrast-enhanced CT of the thorax. Being a referral center for chest diseases we included a great deal number of patients in this unique study.

Material and Methods

Patients

The study included 1000 patients (653 males/ 347 females) who had admitted to our hospital with pulmonary complaints and undergone a contrast-enhanced CT of the thorax for the evaluation of hilar enlargement on PA chest radiography, between January 1, 2011, and March 31, 2013. PA chest radiographs were just evaluated by the clinician who referred the patient to thoracic CT evaluation. The patients who had accompanying radiological findings (such as atelectasis, consolidation, pulmonary nodules or pleural effusion) declared on the request form were all excluded from the study, and patients were included if the requesting physician mentioned the hilar enlargement as the only reason for CT request. The CT images of the patients were retrieved from the archive and re-evaluated. The files of patients were retrieved from the archive, and available study forms were duly filled in. The demographic, clinical, radiological characteristics and pathological findings were recorded on these forms. This study was conducted retrospectively. For this reason, we have not received the patient confirmation form. With the retrospective design, the study was approved by the Local Institutional Ethics Committee.

Computed tomography of the thorax

Contrast-enhanced CT scans of the thorax were all carried out with a Somatom Emotion 6 scanner (Siemens Medical Systems, Forchheim, Germany), with a 6x3 mm collimation, a pitch of 0.75 and a reconstruction thickness of 10 mm. An intravenous iodine contrast agent (iohexol-300) was used in all patients with a dose of 1.2 ml/kg. In this study, we investigated only whether the hilum was normal. The lung parenchyma was not evaluated. The abnormal group includes only vascular dilatation, only lymphadenopathy, vascular dilatation and lymphadenopathy, hilar mass. Hiatal hernia, retrosternal goitre etc. were excluded from the study. We evaluated both hila on thoracic CT regarding the diameter of pulmonary arteries and hilar lymph nodes. A right pulmonary artery diameter larger than 20 mm and left pulmonary artery diameter larger than 22 mm are considered as vascular dilatation [3,4]. The short axis diameter of a lymph node equal to or larger than 11 mm is considered as lymphadenomegaly [5,6].

Statistical Analysis

SPSS for Windows release 15.0 package program was used to carry out the statistical analysis. The descriptive analysis was expressed in terms of frequency, mean, and standard deviation. Comparisons of ordinal parameters between different groups were performed by the Chi-Square test. Comparisons of continuous parameters between different groups were performed by nonparametric Mann-Whitney-U test. A p-value less than 0.05 was considered to be statistically significant.

Results

The study included 653 males (65.3%) and 347 females (34.7%) with a mean age of 55.5±13.6 and 57.9±14.2 years, respectively. Based on PA chest radiography findings, the clinician requested a contrast-enhanced CT of the thorax for the evaluation right hilar enlargement in 412 (41.2%), left hilar enlargement in 381 (38.1%), and bilateral hilar enlargement in 207 (20.7%) patients. Thoracic CT findings were normal in 588 (58.8%) and abnormal in 412 (41.2%) patients. There was vascular dilatation in 248 (24.8%), lymphadenopathy in 87 (8.7%), both vascular dilatation and lymphadenopathy in 59 (5.9%), and mass lesion in 18 (1.8%) patients. Excluding the vascular dilatations, thoracic CT findings were abnormal in 16.4% of the patients. Patients' demographic data, clinicians' impression noted on the request forms about the hila on PA chest radiography, and thoracic CT findings of the study population are seen in Table 1. Examples of bilateral hilar lymphadenopathy, bilateral pulmonary vascular dilatations and left hilar mass are seen in Figure 1, 2 and 3. Thoracic CT findings of patients with the right, left or bilateral hilar enlargement on PA chest radiography are listed in Table 2. Thoracic CT findings were more commonly found to be normal when there is left hilar enlargement compared to right on PA chest radiography (68% vs 52.2%, p<0.001). When the patients were grouped based on gender, thoracic CT findings were significantly different as seen in Table 3. While normal findings

Table 1. Patient characteristics, PA chest radiography and thoracic CT findings of the study population

Patients	653 males 347 females	Mean age: 55.5±13.6 years Mean age: 57.9±14.2 years
PA chest radiography	Right hilar enlargement Left hilar enlargement Bilateral hilar enlargement	412 (41.2%) 381 (38.1%) 207 (20.7%)
Thoracic CT	Normal Vascular dilatation Lymphadenopathy Vascular dilatation + lymphadenopathy Mass	588 (58.8%) 248 (24.8%) 87 (8.7%) 59 (5.9%) 18 (1.8%)

PA: Postero-Anterior
CT: Computed Tomography

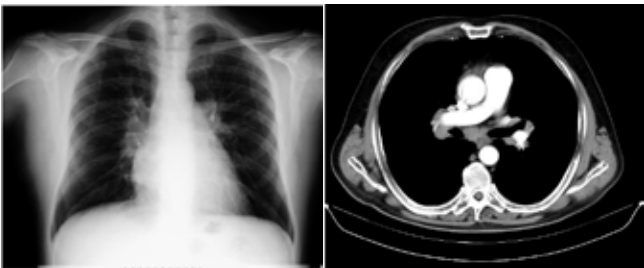


Figure 1. PA chest radiography demonstrating bilateral hilar enlargement and thoracic CT images demonstrating bilateral hilar and subcarinal lymphadenopathy (a,b)

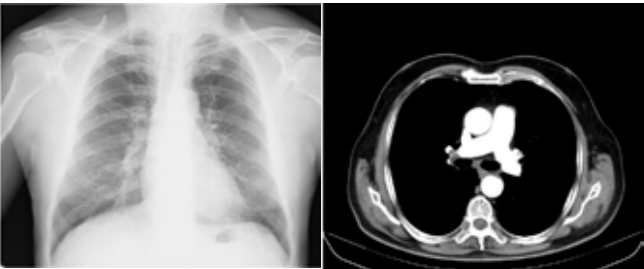


Figure 2. PA chest radiography and thoracic CT images of bilateral pulmonary vascular dilatations (a,b).

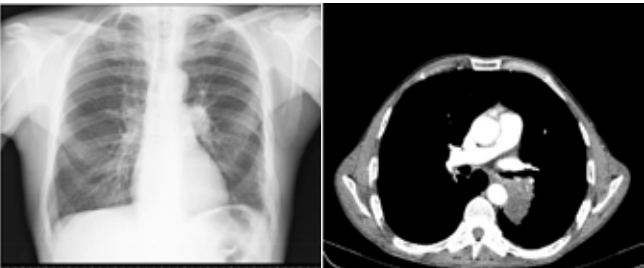


Figure 3. PA chest radiography demonstrating left hilar enlargement and thoracic CT images demonstrating left hilar mass (a,b).

were more common in males (61.6% vs 53.6%), vascular dilatation was more common in females when we used a cut off value 20 mm for right pulmonary artery and 22 mm for the left pulmonary artery (33.1% vs 20.4%, respectively) ($p<0.001$). We think that is because we used same reference values for arterial enlargement in men and women as there is no clear data in the literature about the differences in an average diameter of pulmonary arteries between males and females. We reached a definitive diagnosis after diagnostic work-up in 51 patients (5.1%) as seen in Table 4. Interstitial lung disease ($n=28$, 2.8%) and lung cancer ($n=16$, 1.6%) were the most common diagnoses.

Discussion

In this study, we reviewed the thoracic CT findings of the patients for whom the CT was ordered by a chest diseases specialist in order to evaluate hilar enlargement seen on PA chest radiography. Thoracic CT findings were abnormal in 412 (41.2%) patients. Vascular dilatation was the most common etiology of hilar enlargement with a ratio of 24.8%. Excluding vascular dilatations, thoracic CT findings were abnormal in 16.4% of the patients. After diagnostic work-up, a definitive diagnosis was reached in 51 patients (5.1%). Chest radiography is the first and easiest method to evaluate a patient who admitted with pulmonary complaints. However, it is considered one of the most complex imaging modalities to interpret [7]. Technical modifications such as digitalization improved the diagnostic accuracy of chest radiographs [8,9]. Despite our reliance on chest radiography, our ability to confidently diagnose and accurately document our findings can be unreliable [10]. There are some difficulties in the interpretation of PA chest radiography. One of them is the interpretation of hila which is an important step of the systematic review of the chest radiography. Contrast-enhanced CT is superior in assessing hilar pathologies properly. In this study, more than 40% of the patients have abnormal findings on CT of the thorax. Vascular dilatation was the most common etiology of hilar enlargement with a ratio of nearly

Table 2. Thoracic CT findings of patients with the right, left or bilateral hilar enlargement on PA chest radiography

Thoracic CT findings	PA chest radiography findings			Total
	Right hilar enlargement	Left hilar enlargement	Bilateral hilar enlargement	
Normal	215 (52.2%)	259 (68%)	114 (55.1%)	588
Vascular dilatation	112 (27.2%)	80 (21%)	56 (27.1%)	248
Lymphadenopathy	38 (9.2%)	27 (7.1%)	22 (10.6%)	87
Vascular dilatation + lymphadenopathy	34 (8.2%)	10 (2.6%)	15 (7.2%)	59
Mass	13 (3.2%)	5 (1.3%)	-	18
Total	412	381	207	1000

PA: Postero-Anterior
CT: Computed Tomography

Table 3. Thoracic CT findings of male and female patients

Thoracic CT findings	Gender		Total
	Males	Females	
Normal	402 (61.6%)	186 (53.6%)	588
Vascular dilatation	133 (20.4%)	115 (33.1%)	248
Lymphadenopathy	58 (8.9%)	29 (8.4%)	87
Vascular dilatation + lymphadenopathy	44 (6.7%)	15 (4.3%)	59
Mass	16 (2.5%)	2 (0.6%)	18
Total	653	347	1000

CT: Computed Tomography

Table 4. The definitive diagnoses after diagnostic work-up that can alter management of the patients

Definitive diagnosis	Thoracic CT findings	N
Interstitial lung disease	Lymphadenopathy	16
Interstitial lung disease	Vascular dilatation + Lymphadenopathy	12
Lymphoproliferative disease	Lymphadenopathy	1
Metastasis from extrapulmonary tumors	Lymphadenopathy	4
Lung cancer	Mass	16
Timoma	Mass	1
Granulomatous inflammation	Mass	1

CT: Computed Tomography
N: Number of patients

25%. The degree of dilatation of the central pulmonary arteries varies considerably, not only among the various entities that cause pulmonary arterial hypertension but also from patient to patient with the same condition. Therefore, although the radiographic changes are reasonably specific, they are neither sensitive nor correlate well with the severity of hypertension [11]. In our study group, we just measure the diameters of the left and right pulmonary arteries. We considered pulmonary vascular dilatation as a right pulmonary artery diameter larger than 20 mm and left pulmonary artery diameter larger than 22 mm. As there is no clear data in the literature about the differences in an average diameter of pulmonary arteries between males and females, this possible difference must be further examined. We do not know the severity of hypertension that can be detected by echocardiography. Such a high ratio of vascular dilatation can be a result of certain factors such as 1) Our hospital is a referral center for chest diseases and our patient population is mostly comprise heavy smokers with chronic obstructive pulmonary disease and secondary pulmonary hypertension, 2) The physicians are extremely alert about missing a diagnosis of bronchogenic carcinoma that they frequently order a thoracic CT for their patients 3) In our hospital, CT is readily available

and hence most of the clinicians do not hesitate to order CT examinations in case of any suspicion for hilar pathologies.

Excluding vascular dilatations, thoracic CT findings were abnormal in 16.4% of the patients that justify the request for a CT of the thorax. While 8.7% of the patients had lymphadenopathies, 5.9% had vascular dilatations and lymphadenopathies and 1.8% has hilar mass. Normal hilar lymph nodes are not recognizable on PA chest radiographs but are identifiable at contrast-enhanced CT of the thorax as triangular or linear soft tissue densities. The normal range of size of hilar lymph nodes has been suggested as a short axis diameter of 3 mm [12]. In this study, 28 patients had lymphadenopathies associated with interstitial lung disease, 4 patients with metastasis from extrapulmonary tumors and 1 with the lymphoproliferative disease. Other lymphadenopathies (n=113) were attributed to reactive enlargement.

In this study, a definitive diagnosis that can alter the management was reached in 51 patients (5.1%) after diagnostic work-up. Interstitial lung disease associated with lymphadenopathies and vascular dilatation, lung cancer presented as hilar mass lesions were the most common diagnoses. The ratio of lung cancer was 1.6%.

Thoracic CT findings were more commonly found to be normal when there is left hilar enlargement compared to right on PA chest radiography. This can be explained by the anatomy of the left pulmonary artery that is normally larger than the right. When we compare males to females, while normal thoracic CT findings were more common in males, vascular dilatations were more common in females. Although we do not know the exact smoking history of our male patient population, we know that in our country, males smoke more than females and the lung cancer incidence is higher in males [13]. Therefore, the physicians are more prone to request a thoracic CT for the evaluation of hilar enlargement in male patients with a high smoking history, with the suspicion of bronchogenic carcinoma.

The most important limitation of this study was the lack of interpretation of the PA chest radiographs by the study team. Since the study population was large and we could not reach all PA chest radiographs retrospectively, we relied on the interpretation of chest physicians that was declared on the request forms. But we can argue that this study is performed in a referral hospital for chest diseases and chest surgery and the clinicians are extremely experienced in the interpretation of PA chest radiographs.

Conclusion

The interpretation of hilar pathologies on PA chest radiographs is difficult. A contrast-enhanced thoracic CT is the best way to determine the etiology of hilar enlargement. In this study, the ratio of abnormal findings was 41.2%. Excluding vascular dilatations, thoracic CT findings were abnormal in 16.4% of the patients. We think that these ratios were high enough to justify the request of thoracic CT by the physicians.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Fraser RS, Pare JAP, Fraser RG. The normal chest. In: Synopsis of diseases of the chest. Fraser FS, Pare JAP, Fraser RG, Pare PD, editors. 2nd ed. Philadelphia: W.B. Saunders Company; 1994.p. 1-116.
2. Glazer GM, Francis IR, Shirazi KK, Bookstein FL, Gross BH, Orringer MB. Evaluation of the pulmonary hilum: comparison of conventional radiography, 55 degrees posterior oblique tomography, and dynamic computed tomography. J Comput Assist Tomogr. 1983;7:983-9.
3. Kuriyama K, Gamsu G, Stern RG, Cann CE, Herfkens RJ, Brundage BH. CT-determined pulmonary artery diameters in predicting pulmonary hypertension. Invest Radiol. 1984;19:16-22.
4. Bozlar U, Ors F, Deniz O, Uzun M, Gumus S, Ugurel MS, et al. Pulmonary artery diameters measured by multidetector-row computed tomography in healthy adults. Acta Radiol. 2007; 48 (10): 1086-91.
5. Genereux GP, Howie JL. Normal mediastinal lymph node size and number: CT and anatomic study. AJR Am J Roentgenol. 1984; 142: 1095-100.
6. Ingram CE, Belli AM, Lewars MD, Reznick RH, Husband JE. Normal lymph node size in the mediastinum: a retrospective study in two patient groups. Clin Radiol. 1989;40:35-9.
7. Gatt ME, Spectre G, Paltiel O, Hiller N, Stalnikowicz R. Chest radiographs in the emergency department: is the radiologist really necessary? Postgrad Med J. 2003; 79: 214-7.
8. Siela D. Chest radiograph evaluation and interpretation. AACN Adv Crit Care. 2008;19:444-73.
9. Goodman LR, Wilson CR, Foley WD. Digital radiography of the chest: promises and problems. AJR Am J Roentgenol. 1988;150:1241-53.
10. Satia I, Bashagha S, Bibi A, Ahmed R, Mellor S, Zaman F. Assessing the accuracy and certainty in interpreting chest X-rays in the medical division. Clin Med. 2013;13: 349-52.
11. Hansell DM, Armstrong P, Lynch DA, McAdams HP. Pulmonary vascular diseases and pulmonary edema. In: Imaging of diseases of the chest. Hansell DM, Armstrong P, Lynch DA, McAdams HP, editors. 4th ed. Elsevier Mosby; 2005.p.361-428.
12. Remy-Jardin M, Duyck P, Remy J, Petyt L, Wurtz A, Mensier E, et al. Hilar lymph nodes: identification with spiral CT and histological correlation. Radiology. 1995; 19: 387-94.
13. Goksel T, Akkoçlu A. Turkish Thoracic Society, Lung and Pleural Malignancies Study Group. Pattern of lung cancer in Turkey 1994-1998. Respiration. 2002; 69: 207-10.

How to cite this article:

Dadalı Y, Köksal D. Thorax CT findings of patients with hilar enlargement on chest X-Ray. Ann Clin Anal Med 2020;11(3):235-238